

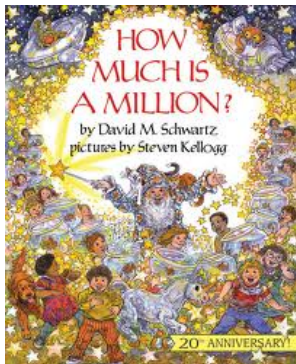
## Chapter 9 Exponents & Scientific Notation

### 9.4 Zero and Negative Exponents

Unit Question: What is the power of powers?

Learner Profile: Reflective

Area of Interaction: Community & Service



## I Can Statement:

I can use the definitions of zero and negative exponents to evaluate and simplify expressions.



## Quiz

Paper out and do!!!

1.  $7 \cdot 7 \cdot m \cdot m \cdot m$   
 $49m^3$

2.  $(-2)^6$   $64$

3.  $(3c)^4$   $81c^4$

4.  $\left(-\frac{2}{7}p\right)^2$   $\frac{4}{49}p^2$

5.  $\frac{\pi^{15}}{\pi^3 \cdot 3\pi^9}$   
 $\pi$

6. **CRITICAL THINKING** Is  $(ab)^2$  equivalent to  $ab^2$ ?  
 Explain. (Section 9.2)

$(ab)^2 = ab \cdot ab$   $ab^2 = a \cdot b \cdot b$

7. **EARTHQUAKES** An earthquake of magnitude 3.0 is  $10^2$  times stronger than an earthquake of magnitude 1.0. An earthquake of magnitude 8.0 is  $10^7$  times stronger than an earthquake of magnitude 1.0. How many times stronger is an earthquake of magnitude 8.0 than an earthquake of magnitude 3.0? (Section 9.3)

$10^5$

Read the example.

Talk about the following notation.

Thousands	Hundreds	Tens	Ones
↓	↓	↓	↓

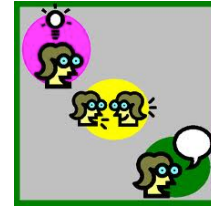
$$4327 = 4 \cdot 10^3 + 3 \cdot 10^2 + 2 \cdot 10^1 + 7 \cdot 10^0$$

What patterns do you see in the first three exponents?

Continue the pattern to find the fourth exponent.

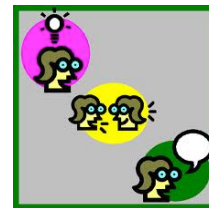
How would you define  $10^0$ ? Explain.

# Think, Pair, Share



How would you define  $10^0$ ? Why?

# Think, Pair, Share



Compare the two methods used to simplify  $\frac{3^2}{3^5}$ . Then describe how you can rewrite a power with a negative exponent as a fraction.

*Method 1*

$$\frac{3^2}{3^5} = \frac{\overset{1}{3} \cdot \overset{1}{3}}{\underset{1}{3} \cdot \underset{1}{3} \cdot 3 \cdot 3 \cdot 3}$$

$$= \frac{1}{3^3}$$

*Method 2*

$$\frac{3^2}{3^5} = 3^{2-5}$$

$$= 3^{-3}$$

On your paper with quiz, answer the question.

# Think, Write, Share

**IN YOUR OWN WORDS** How can you define zero and negative exponents?  
Give two examples of each.

1 minute to write, then I  
will say when to share.

## Key Ideas

### Zero Exponents

**Words** Any nonzero number to the zero power is equal to 1. Zero to the zero power,  $0^0$ , is *undefined*.

**Numbers**  $4^0 = 1$

**Algebra**  $a^0 = 1$ , where  $a \neq 0$

### Negative Exponents

**Words** For any integer  $n$  and any number  $a$  not equal to 0,  $a^{-n}$  is equal to 1 divided by  $a^n$ .

**Numbers**  $4^{-2} = \frac{1}{4^2}$

**Algebra**  $a^{-n} = \frac{1}{a^n}$ , where  $a \neq 0$

What if you have  $\frac{1}{a^{-n}} = a^n$

$3^2 = \frac{1}{3^{-2}}$

Evaluate the expression. Put on paper.

1.  $4^{-2}$

$$\frac{1}{4^2}$$

$$\frac{1}{4 \cdot 4}$$

$$\frac{1}{16}$$

2.  $(-2)^{-5}$

$$\frac{1}{(-2)^5}$$

$$\frac{1}{(-2)(-2)(-2)(-2)(-2)}$$

$$\frac{1}{-32}$$

$$-\frac{1}{32}$$

3.  $6^{-8} * 6^8$

$$6^0$$

$$1$$

Evaluate the expression. Put on paper.

4.  $\frac{(-3)^5}{(-3)^6}$

$$(-3)^{-1}$$

$$\frac{1}{(-3)}$$

$$-\frac{1}{3}$$

5.

$$\frac{1}{5^7} * \frac{1}{5^{-4}} = 5^{-3} \text{ OR } \frac{1}{5^3}$$

$$\rightarrow -7 + 4 = -3$$

Evaluate the expression.

Put on paper.

$$\frac{-2a^3}{10a^8}$$

$$-\frac{2}{10} \quad \frac{aaa}{\cancel{aaaaaa}}$$

$$-\frac{1}{5a^5} \quad -\frac{a^5}{5}$$

Evaluate the expression.

Put on paper.

$$\frac{p^{-4}q^{-3}}{(p^5q^2)^{-1}}$$

Remember the previous lesson. Power of a power.

$$p^{-5}q^{-2} \quad p^{-4}q^{-3}$$

$$\frac{p^5q^2}{p^4q^3} \quad \frac{p^{-4}q^{-3}}{p^{-5}q^{-2}}$$

$$\frac{p}{q} \quad \frac{p^1q^1}{p^{-1}q^{-1}} \quad \text{or} \quad \frac{p^1q^1}{p^{-1}q^{-1}}$$

Put on paper.



Exit Quiz!!!

Simplify:

1.  $4x^{-3}$

$$\frac{4}{x^3}$$

$$(4x)^{-3} = \frac{1}{(4x)^3}$$

$$\frac{1}{64x^3}$$

2.  $\left(\frac{3x^5y}{8xy^7}\right)^0$

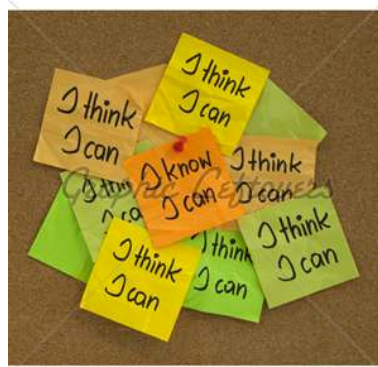
$$1$$

3.  $\frac{18x^3y^4z^7}{-2x^2yz}$

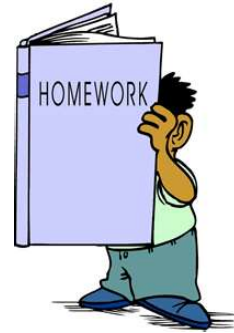
$$-9x^3y^3z^6$$

# I Can Statement:

I can use the definitions of zero and negative exponents to evaluate and simplify expressions.



# Assignment:



Textbook p.374-375  
9-32all

Review Worksheet  
9.1-9.3